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**The Role of the U.S. Nuclear Waste
Technical Review Board**



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About the Board

- The Board was created by Congress in the Nuclear Waste Policy Amendments Act (NWPAA) of 1987.
- There are eleven Board members who are nominated by the National Academy of Sciences solely on the basis of expertise.
- Members are then appointed by the President and serve a four-year term. They can be reappointed.
- All members serve part-time.
- Members' areas of expertise range from geochemistry to materials science to hydrology to transportation.
- The full Board meets 3-4 times per year, usually in Nevada; Board panels hold meetings periodically.

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About the Board (cont.)

- Board is supported by a full-time staff consisting of 10 professionals and 5 support personnel.
- The Board's budget is approximately \$3 million a year.
- Congress appropriates money from the Nuclear Waste Fund to pay for Board activities.
- According to the Board's legislation, it will stay in existence until one year after the first high-level radioactive waste or spent fuel is disposed of in a repository.

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The Board's Role

- The Board conducts an independent evaluation of the technical and scientific validity of activities undertaken by the Secretary of Energy to implement the 1982 Nuclear Waste Policy Act as amended.
- The Board is an independent agency, but it is part of the Executive Branch.
- The Board reports its findings and recommendations to Congress and the Secretary at least two times each year.
- The Board has no regulatory or implementing authority.
- Under the NWPA, the Board has access to draft documents prepared by the Department of Energy and its contractors so that it can conduct its review in "real time," not after the fact.

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Technical and Scientific Challenges

- Water flow and radionuclide transport in fractured unsaturated rocks
- Highly non-linear coupled processes resulting from hot spent fuel emplaced using an above-boiling design
- Low-probability, high-consequence volcanic scenarios not observed in nature
- Reconstruction of earthquake history
- Reliability of very long-term geologic predictions
- Age dating in the Quaternary

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Technical and Scientific Challenges (cont.)

- Extrapolating long-term materials performance
- Discovering useful analogs
- Physical and chemical environment underground
- Predicting corrosion rates and processes at high temperatures
- Fabricating waste packages
- Welding and inspecting waste packages in a highly radioactive environment

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Some Important Board Recommendations

- *Board recommendation:* Use horizontal tunnels to characterize the underground at Yucca Mountain (DOE plans had called for vertical shafts).
- *DOE action:* DOE revised its plans and constructed the exploratory studies facility (ESF).

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Board Recommendations (cont.)

- *Board recommendation:* Use TBM to excavate exploratory drifts (early DOE plans included drill-and-blast excavation method).
- *Board recommendation:* Use smaller (16-18 ft.) TBM (DOE originally planned to use 32-ft. TBM).
- *DOE action:* Excavated tunnels using 25-ft. TBM.

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Board Recommendations (cont.)

- *Board recommendation:* Excavate a tunnel off the ESF through the proposed waste-emplacement area (the DOE had originally planned such a tunnel but later abandoned these plans).
- *DOE action:* Constructed the east-west cross drift.

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Board Recommendations (cont.)

- *Board recommendation:* Compare performance of "hot" and "cold" repository designs (DOE's base-case includes an above-boiling design for the postclosure period).
- *DOE action:* Performed comparison showing no difference in performance for high- or low-temperature operating modes.

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Board Recommendations (cont.)

- *Board's four priorities for site recommendation:*
 - Meaningful quantification of uncertainty
 - Progress in understanding corrosion processes
 - Comparison of "hot" and "cold" designs
 - Development of multiple lines of evidence
- *DOE action:* Varied

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Board Recommendations (cont.)

- *Board's conclusion about deliquescence-induced corrosion of Alloy 22 at high temperatures:*

"Based on DOE data, the Board believes that under conditions associated with the DOE's current high-temperature repository design, widespread corrosion of the waste packages is likely to be initiated during the thermal pulse. Once started, such corrosion is likely to propagate rapidly even after conditions necessary for initiation are no longer present. The result would be perforation caused by localized corrosion of the waste packages, with possible release of radionuclides." (11/03)
- *DOE Action:* Undertook extensive evaluation of in-drift environment
- *Board Response:*

Although the extent to which the DOE has characterized accurately the likely waste package environments remains unclear, "the Board now concludes that deliquescence-induced localized corrosion during the higher-temperature period of the thermal pulse is unlikely." (7/04)

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The Board's Role Relative to the Decision-Making Process

- Most policy decisions, such as the DOE's site recommendation, are based on technical and non-technical considerations.
- Board provides technical and scientific input to the policy/decision-making process.
- Board strives to provide its technical and scientific evaluation to policy makers before decisions are made, not after the fact.

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Board's January 2002 Letter to Congress and the Secretary

- Took no position on whether to recommend the Yucca Mountain site.
- Found that the DOE's technical basis for its performance estimates was weak to moderate.
- Conveyed the Board's limited confidence in performance estimates.
- Stated that no individual technical or scientific factor had been identified at that point that would automatically eliminate Yucca Mountain from consideration.
- Listed several ways to enhance confidence in performance estimates.

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Did Policy Makers Use This Information?

The answer to the question is: Yes

- Those opposed to the site recommendation used the Board's finding of "weak to moderate" to make the case that the site *was not* good enough.
- Those in favor of the site recommendation used the Board's statement on disqualifying factors to make the case that the site *was* good enough.
- The better question may be: How much did technical and scientific considerations influence the opinion of either group?

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Challenges in Assessing the Effectiveness of the Board's Review

- The Board has no implementing authority.
- Change in confidence in validity is a judgment determined by others outside the Board.
- Other entities make similar recommendations.
- Board recommendations affect the program incrementally over time.

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The Board's Future Role

- The repository program has changed in at least two major ways: First, the focus of DOE activities has shifted from characterization to compliance. Second, decision-making has moved from the executive and legislative environment, i.e., the White House and Congress to a regulatory environment, i.e., the Nuclear Regulatory Commission.
- The Board's congressional mandate to provide independent and ongoing evaluation of the DOE's activities has not changed.
- While continuing its review in geoscientific areas, the Board's evaluation will reflect an expected increase in DOE activities related to the waste management system and design and engineering.

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